MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2016/2017

BQT1614 – QUANTITATIVE ANALYSIS

(All sections / Groups)

22 October 2016
9.00 a.m. - 12.00 p.m.
(3 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of **TEN (10)** printed pages inclusive of the cover page and formulae sheet.

2. This question paper consists of **FIVE** structured questions. Attempt **ALL** questions.

3. Students are allowed to use non-programmable scientific calculators with no restrictions.

4. Statistical tables are attached at the end of the question paper.

5. Please use **pen** to write the answers.

6. Please print all your answers in the **Answer Booklet** provided.

Question 1 [Total = 20 Marks]

The following data give the weight (in pounds) lost by 15 new members of a health club at the end of their first two months of membership.

5	10	8	7	25	12	5	14
11	10	21	9	8	10	18	

a) Compute the point estimate for the population mean and standard deviation of the weight lost. [3 marks]

b) Compute the interquartile range for the weight lost. [5 marks]

c) Determine the mode and coefficient of variation provided the variance from past history was 29.16 pounds. [3 marks]

d) Construct the 90% confidence interval for the population mean weight lost. [5 marks]

e) Determine the sample size needed in order to have the estimation to be 95% confidence within ± 0.75 pounds given the variance from past history was 29.16 pounds. [4 marks]

Question 2 [Total = 20 Marks]

a) Five patients need to undergo an operation that has a success rate of 0.8. Assuming that each operation is independent of each other, find

(i) the probability that none of the operation fail. [2 marks]

(ii) the probability that not more than two patients will undergo the operation successfully. [4 marks]

(iii) the probability that one to two patients failed their operation. [3 marks]

b) The price of laptops sold in the annual PC fair at PWTC is approximately normally distributed with mean of RM1800 and standard deviation of RM100.

(i) What is the probability that a randomly selected laptop costs at least RM2100. [3 marks]

(ii) What is the probability that a randomly selected laptop costs between RM1600 and RM2000? [4 marks]

(iii) If 12% of the laptops sold in PC fair are the least expensive ones, find the price below for the least expensive laptops. [4 marks]

Continued.....

Question 3 [Total = 20 Marks]

a) As part of a national study of economic competitiveness a marketing research firm randomly sampled 200 adults between the ages of 27 and 35 living in Kuala Lumpur and 180 adults between the ages of 27 and 35 living in Melaka. Each adult selected in the sample was asked, among other things, whether or not they had an undergraduate degree. Sixty-six (66) adults from Kuala Lumpur and 63 adults from Melaka answered 'yes' when asked if they had a degree. Based on the sample data, can you conclude that there is a difference between the population proportions of adults between the ages of 27 and 35 in the two cities with undergraduate degrees? Use a 0.01 level of significance to conduct the appropriate hypothesis test.

[12 marks]

b) A random sample of 10 students contains the following observations, time spent studying in the week before final exams in hours:

28 57 42 35 61 39 55 46 49 38

Is there enough evidence to conclude that the mean time spent on studying in the week before final exams is more than 40 hours? Use $\alpha = 0.05$. [8 marks]

Question 4 [Total = 20 Marks]

The sales and earnings in millions of dollars of randomly selected 12 "Small companies" are reported in the following table:

Sales ($ millions)	Earnings ($ millions)
89.2	4.9
18.6	4.4
18.2	1.3
71.7	8
58.6	6.6
46.8	4.1
17.5	2.6
11.9	1.7
19.6	3.5
51.2	8.2
28.6	6
69.2	12.8

Continued...

a) Identify the independent variable and the dependent variable. [2 marks]
b) Compute the coefficient of correlation and interpret its value. [5 marks]
c) Compute the coefficient of determination and interpret. [3 marks]
d) Determine the Least Square regression equation. [5 marks]
e) Interpret the meaning of the slope. [2 marks]
f) For a small company with $50 million sales, estimate the earnings and comment on the accuracy of the estimate. [3 marks]

Question 5 [Total = 20 Marks]

a) The prices of selected items for 1990 and 2009 follow. Production figures for those two periods are also given.

Items	Price ($)		Quantity	
	1990	2009	1990	2009
Aluminium (cents per pound)	0.28	0.76	1,000	1,200
Natural gas (1000 cu. ft.)	0.17	2.50	5,000	4,000
Petroleum (barrel)	3.18	26.00	60,000	60,000
Platinum (troy ounce)	133.00	490.00	500	600

(i) Determine the Laspeyres price index for 2009 using 1990 as the base period. [3 marks]

(ii) Determine the Paasche price index for 2009 using 1990 as the base period. [3 marks]

b) A newly married couple has $15,000 toward the purchase of a house. For the type of house they are interested in buying they estimate that a $20,000 down payment will be necessary. How long will the money have to be invested at 10% compounded quarterly to grow to $20,000? [3 marks]

c) A company establishes a fund to upgrade a plant in 5 years at an estimated cost of $1,500,000. How much should be invested each quarter into an account paying 9% compounded quarterly? How much interest will the account earn in the 5 years? [5 marks]

d) A family has a $30,000, 20 year mortgage at 15% compounded monthly.
(i) Find the monthly payment. [3 marks]
(ii) Suppose the family decides to add an extra $100 to its mortgage payment each month. How long will it take for the family to pay off the mortgage? [3 marks]

End of Questions

STATISTICAL FORMULAE

A. DESCRIPTIVE STATISTICS

Mean $(\bar{x}) = \dfrac{\sum_{i=1}^{n} X_i}{n}$

Standard Deviation $(s) = \sqrt{\dfrac{\sum_{i=1}^{n} X_i^{\,2}}{n-1} - \dfrac{(\sum_{i=1}^{n} X_i)^2}{n(n-1)}}$

Coefficient of Variation $(CV) = \dfrac{\sigma}{\bar{X}} \times 100$

Pearson's Coefficient of Skewness $(S_k) = \dfrac{3(\bar{X} - Median)}{s}$

B. PROBABILITY

P (A or B) = P (A) + P (B) – P (A and B)

P (A and B) = P (A)× P (B) if A and B are independent

P (A | B) = P (A and B) ÷ P (B)

Poisson Probability Distribution

If X follows a Poisson Distribution , $P(\lambda)$ where $P(X = x) = \dfrac{e^{-\lambda}\lambda^x}{x!}$

then the mean = $E(X) = \lambda$ and variance = $VAR(X) = \lambda$

Binomial Probability Distribution

If X follows a Binomial Distribution B(n, p) where $P(X = x) = {}^nC_x p^x q^{n-x}$

then the mean = $E(X) = np$ and variance = $VAR(X) = npq$ where $q = 1 - p$

Normal Distribution

If X follows a Normal distribution, $N(\mu, \sigma)$ where $E(X) = \mu$ and $VAR(X) = \sigma^2$

then $Z = \dfrac{X - \mu}{\sigma}$

C. CONFIDENCE INTERVAL ESTIMATION AND SAMPLE SIZE DETERMINATION

(100 – α) % Confidence Interval for Population Mean (σ Known) = $\mu = \overline{X} \pm Z_{\alpha/2}\left(\sigma/\sqrt{n}\right)$

(100 – α)% Confidence Interval for Population Mean (σ Unknown) = $\mu = \overline{X} \pm t_{\alpha/2,n-1}\left(s/\sqrt{n}\right)$

(100 – α)% Confidence Interval for Population Proportion = $\pi = p \pm Z_{\alpha/2}\sqrt{\dfrac{p(1-p)}{n}}$

Sample Size Determination for Population Mean $= n \geq \left[\dfrac{(Z_{\alpha/2})\sigma}{E}\right]^2$

Sample Size Determination for Population Proportion $= n \geq \dfrac{Z^2 \times p(1-p)}{E^2}$

Where E = Limit of Error in Estimation

D. HYPOTHESIS TESTING

One Sample Mean Test	
Standard Deviation (σ) Known	**Standard Deviation (σ) Not Known**
$Z = \dfrac{\bar{x} - \mu}{\sigma/\sqrt{n}}$	$t = \dfrac{\bar{x} - \mu}{s/\sqrt{n}}$
One Sample Proportion Test	
$Z = \dfrac{p - \pi}{\sqrt{\dfrac{\pi(1-\pi)}{n}}}$	
Two Sample Mean Test	
Standard Deviation (σ) Known	**Standard Deviation (σ) Not Known**
$z = \dfrac{(\overline{x}_1 - \overline{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\sigma_1^2/n_1 + \sigma_2^2/n_2}}$	$t = \dfrac{(\overline{x}_1 - \overline{x}_2) - (\mu_1 - \mu_2)}{\sqrt{S_p^2\left(1/n_1 + 1/n_2\right)}}$ where $S_p^2 = \dfrac{(n_1-1)S_1^2 + (n_2-1)S_2^2}{(n_1+n_2-2)}$
Two Sample Proportion Test	
$Z = \dfrac{(p_1 - p_2) - (\pi_1 - \pi_2)}{\sqrt{\bar{p}(1-\bar{p})\left(\dfrac{1}{n_1} + \dfrac{1}{n_2}\right)}}$ where $\bar{p} = \dfrac{X_1 + X_2}{n_1 + n_2}$; $p_1 = \dfrac{X_1}{n_1}$; $p_2 = \dfrac{X_2}{n_2}$	
where X_1 and X_2 are the number of successes from each population	

E. REGRESSION ANALYSIS

Simple Linear Regression

Population Model: $Y = \beta_0 + \beta_1 X_1 + \varepsilon$

Sample Model: $\hat{y} = b_0 + b_1 x_1 + e$

Correlation Coefficient

$$r = \frac{\sum XY - \left[\frac{\sum X \sum Y}{n}\right]}{\sqrt{\left[\sum X^2 - \left(\frac{(\sum X)^2}{n}\right)\right]\left[\sum Y^2 - \left(\frac{(\sum Y)^2}{n}\right)\right]}} = \frac{COV(X,Y)}{\sigma_X \sigma_Y}$$

ANOVA Table for Regression

Source	Degrees of Freedom	Sum of Squares	Mean Squares
Regression	1	SSR	MSR = SSR/1
Error/Residual	$n-2$	SSE	MSE = SSE/$(n-2)$
Total	$n-1$	SST	

Test Statistic for Significance of the Predictor Variable

$$t_i = \frac{b_i}{S_{b_i}} \quad \text{and the critical value} = \pm t_{\alpha/2,(n-p-1)}$$

Where p = number of predictor

F. INDEX NUMBERS

Simple Price Index

$$P = \frac{p_t}{p_0} \times 100$$

Laspeyres Quantity Index

$$P = \frac{\sum p_0 q_t}{\sum p_0 q_0} \times 100$$

Aggregate Price Index

$$P = \frac{\sum p_t}{\sum p_0}(100)$$

Paasche Quantity Index

$$P = \frac{\sum p_t q_t}{\sum p_t q_0} \times 100$$

Laspeyres Price Index

$$P = \frac{\sum p_t q_0}{\sum p_0 q_0} \times 100$$

Fisher's Ideal Price Index

$$\sqrt{(\text{Laspeyres Price Index})(\text{Paasche Price Index})}$$

Paasche Price Index

$$P = \frac{\sum p_t q_t}{\sum p_0 q_t} \times 100$$

Value Index

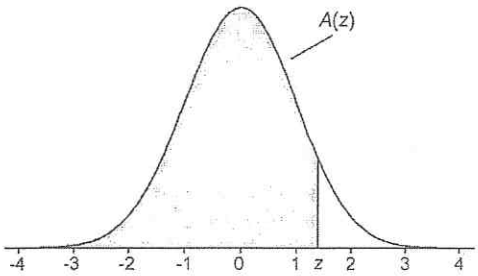
$$V = \frac{\sum p_t q_t}{\sum p_0 q_0} \times 100$$

G. FINANCIAL MATHEMATICS

Simple Interest $I = Prnr$ $A = P(1 + nr)$	**Compounded Interest** $I_t = P[(1+i)^n - 1]$ $A_t = P(1+i)^n$
Effective Rate of Interest $r_{effective} = \left(1 + \frac{r}{m}\right)^n - 1$	**Sinking Fund** $S = R\left[\frac{(1+i)^n - 1}{i}\right]$
Future Value $A_t = P(1+i)^n$	**Present Value** $P = A(1+i)^{-n}$
Future Value of an Annuity $FV_A = R\left[\frac{(1+i)^n - 1}{i}\right]$	**Present Value of an Annuity** $PV_A = R\left[\frac{1-(1+i)^{-n}}{i}\right]$
Amortization $R = \left[\frac{P(i)}{1-(1+i)^{-n}}\right]$	

TABLE A.1

Cumulative Standardized Normal Distribution

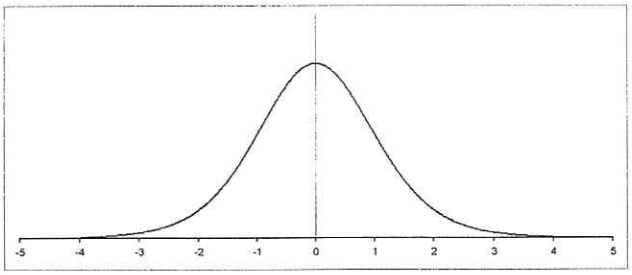


$A(z)$ is the integral of the standardized normal distribution from $-\infty$ to z (in other words, the area under the curve to the left of z). It gives the probability of a normal random variable not being more than z standard deviations above its mean. Values of z of particular importance:

z	$A(z)$	
1.645	0.9500	Lower limit of right 5% tail
1.960	0.9750	Lower limit of right 2.5% tail
2.326	0.9900	Lower limit of right 1% tail
2.576	0.9950	Lower limit of right 0.5% tail
3.090	0.9990	Lower limit of right 0.1% tail
3.291	0.9995	Lower limit of right 0.05% tail

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.5	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
3.6	0.9998	0.9998	0.9999							

Table 2: The t-distribution ($t_{\alpha, n-1}$)



α =	**0.10**	**0.05**	**0.025**	**0.01**	**0.005**	**0.001**	**0.0005**
(n-1) = 1	3.078	6.314	12.706	31.821	63.657	318.309	636.619
2	1.886	2.920	4.303	6.965	9.925	22.327	31.599
3	1.638	2.353	3.182	4.541	5.841	10.215	12.924
4	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	1.337	1.746	2.120	2.583	2.921	3.686	4.015
17	1.333	1.740	2.110	2.567	2.898	3.646	3.965
18	1.330	1.734	2.101	2.552	2.878	3.610	3.922
19	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	1.325	1.725	2.086	2.528	2.845	3.552	3.850
21	1.323	1.721	2.080	2.518	2.831	3.527	3.819
22	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	1.319	1.714	2.069	2.500	2.807	3.485	3.768
24	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	1.316	1.708	2.060	2.485	2.787	3.450	3.725
26	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	1.314	1.703	2.052	2.473	2.771	3.421	3.690
28	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	1.311	1.699	2.045	2.462	2.756	3.396	3.659
30	1.310	1.697	2.042	2.457	2.750	3.385	3.646
40	1.303	1.684	2.021	2.423	2.704	3.307	3.551
60	1.296	1.671	2.000	2.390	2.660	3.232	3.460
120	1.289	1.658	1.980	2.358	2.617	3.160	3.373
∞	1.282	1.645	1.960	2.326	2.576	3.090	3.291